Submission Questions:

18.

a) What operating system (including revision) did you use for your code development?

Ans: Windows 11

b) What compiler (including revision) did you use?

Ans: SDCC

c) What exactly (include name/revision if appropriate) did you use to build your code (what IDE, make/makefile, or command line)?

Ans:STM32CubeIDE 1.13.2 and CodeBlocks:SDCC

d) Did you install and use any other software tools to complete your lab assignment?

Ans No.

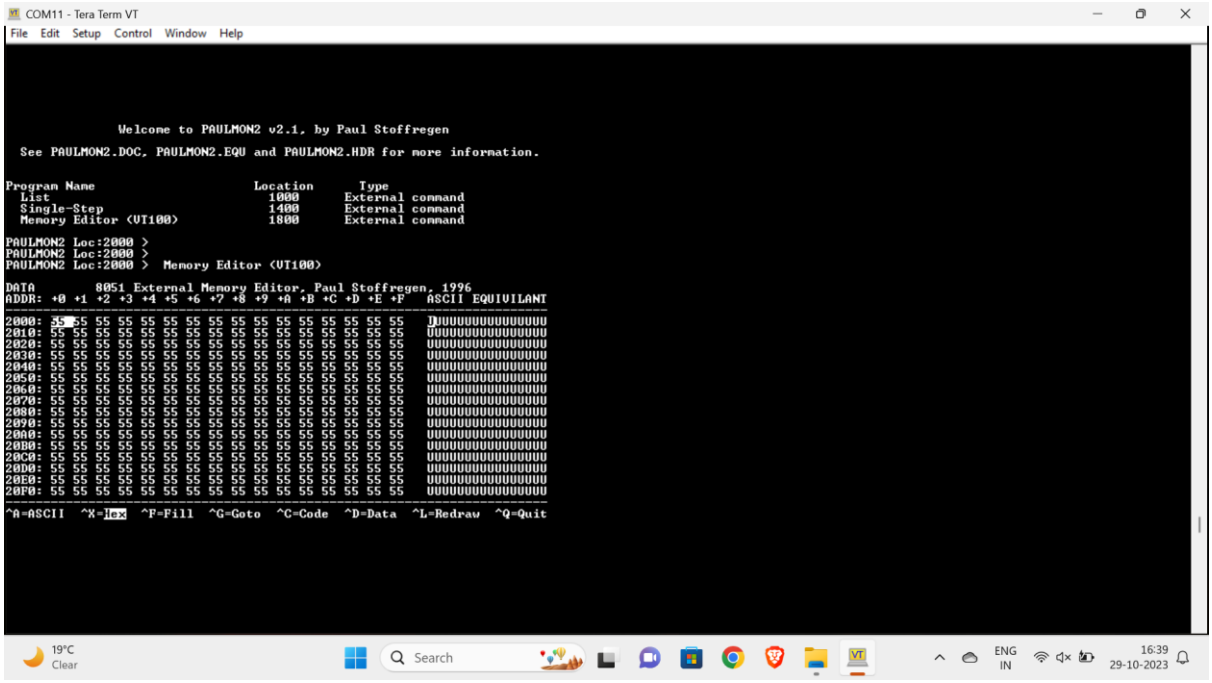
e) Did you experience any problems with any of the software tools? If so, describe the problems.

Ans: No

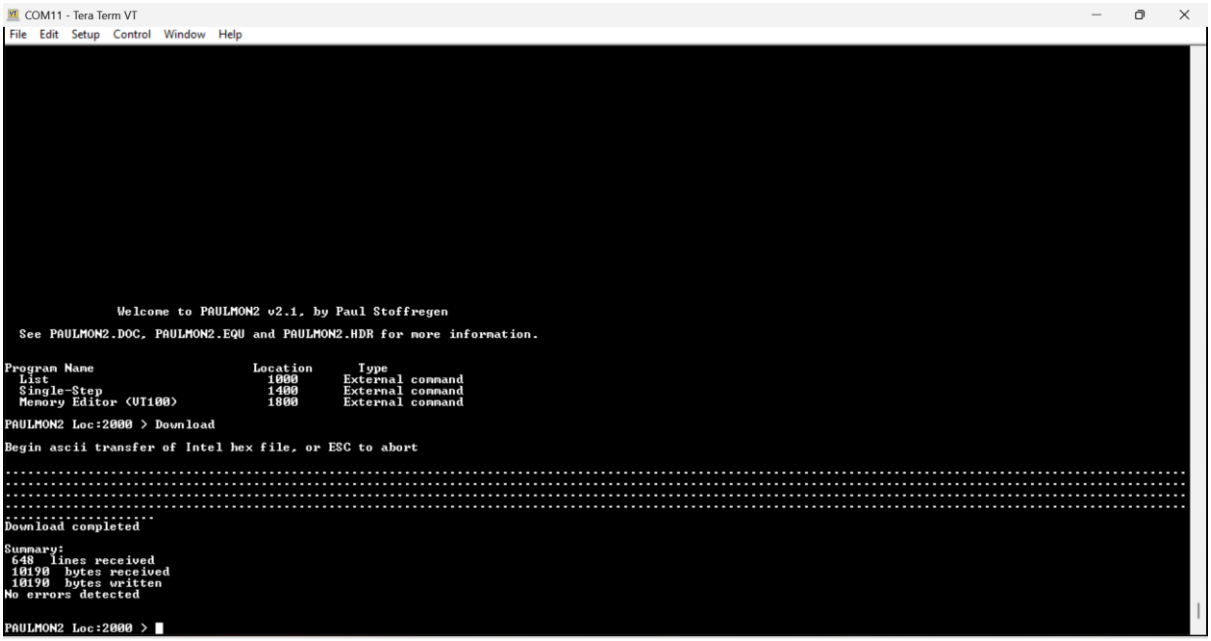
Pictures/Screenshots:

1. Part 1: Terminal output after filling the data segment with a “U” character (55).

Data segment:



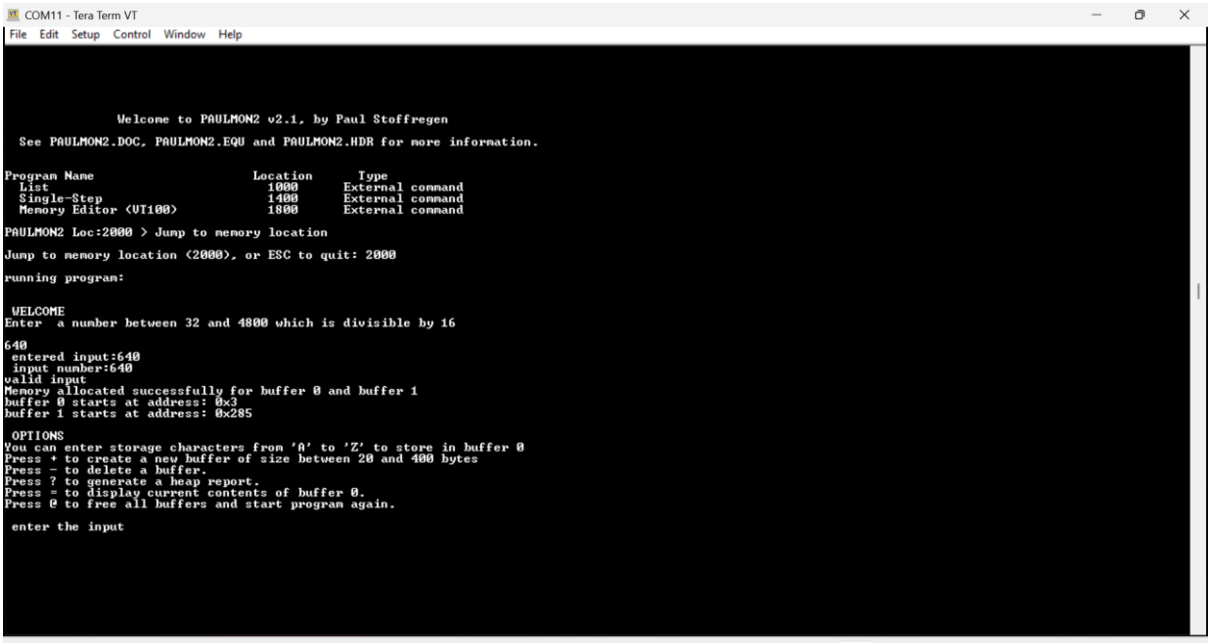
Downloading a file using “D” command in PAULMON2.



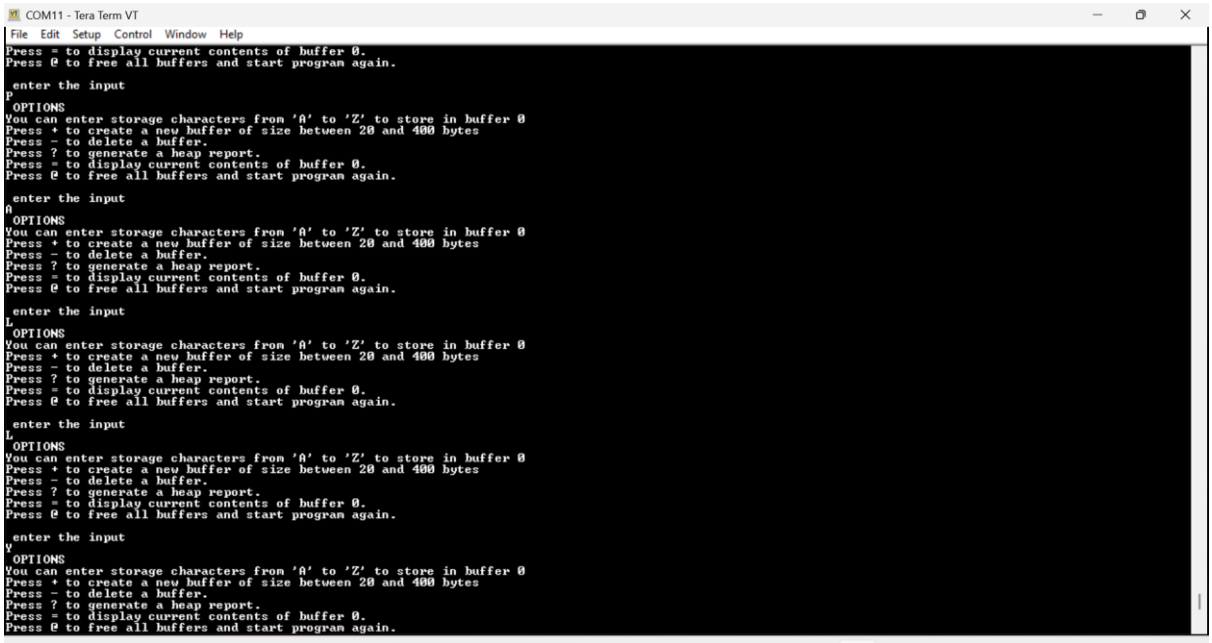
2.**Part2:** Creating buffers.

Creating buffers 0 and 1 with equal size with the input number which is between 32 and 4800 both inclusive.

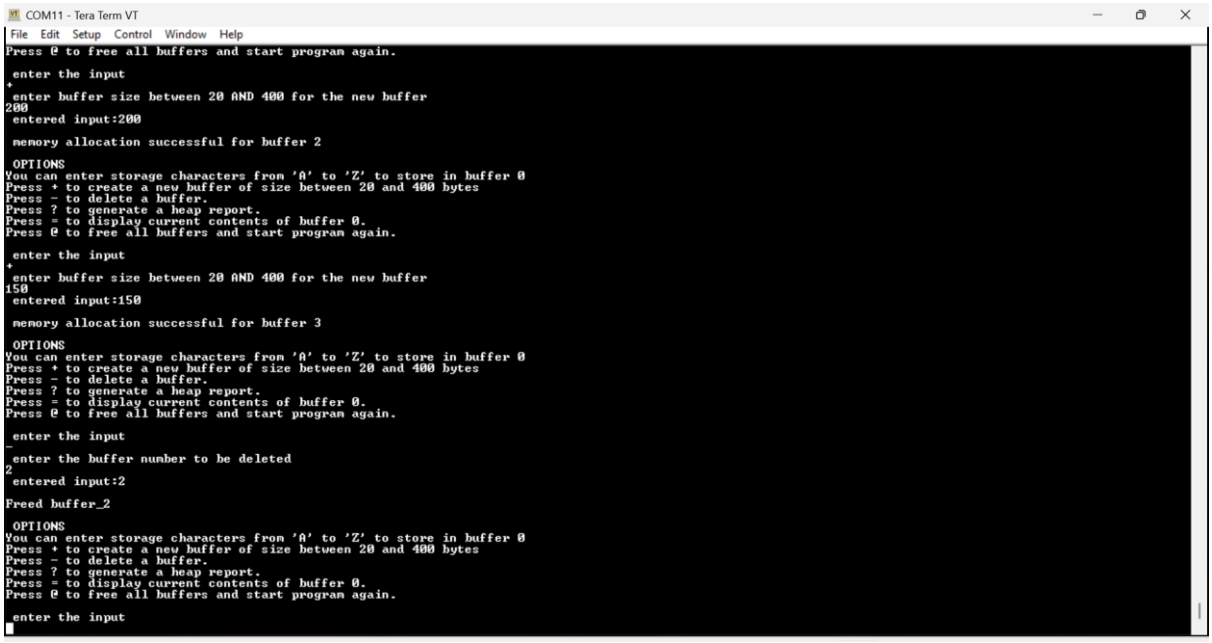
The input number must be divisible by 16.



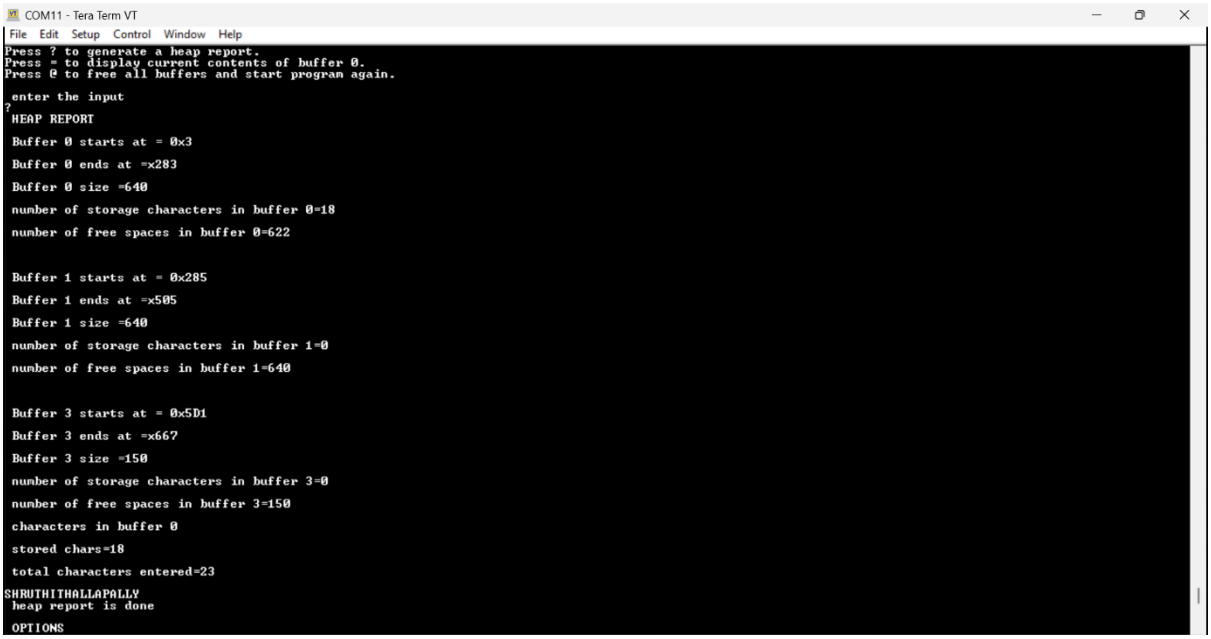
Terminal output when the input is a storage character.



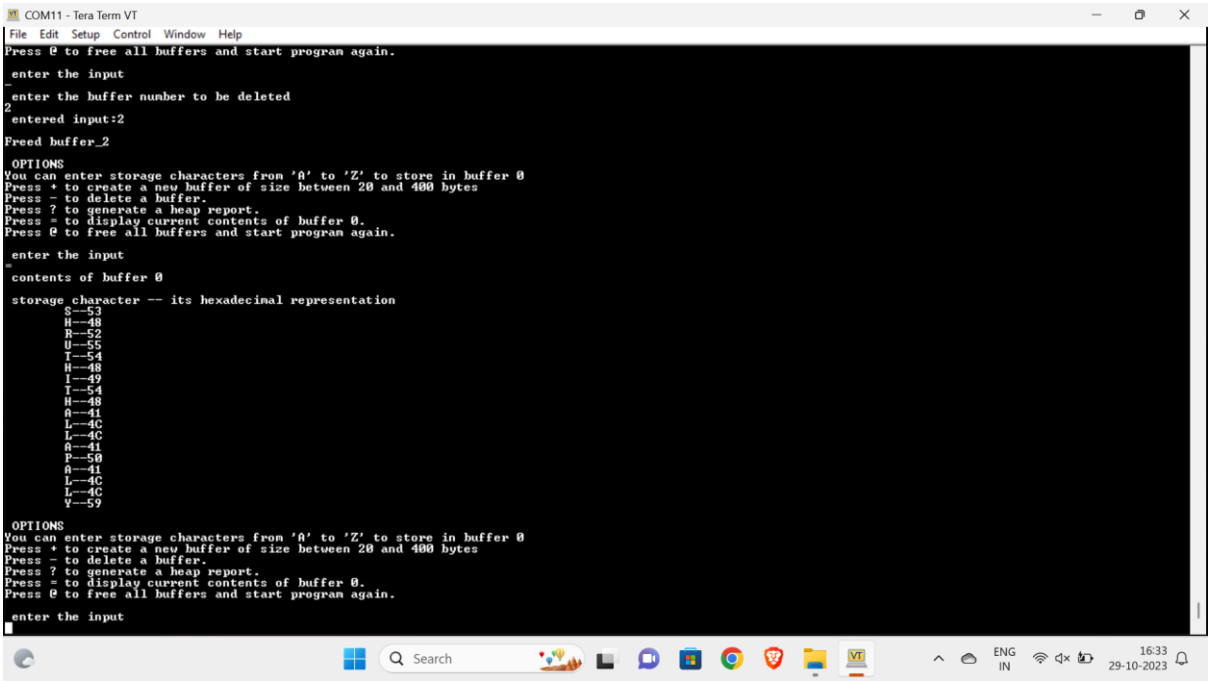
Terminal output when the input is “+”, creating new buffers whose size must be between 20 and 400.



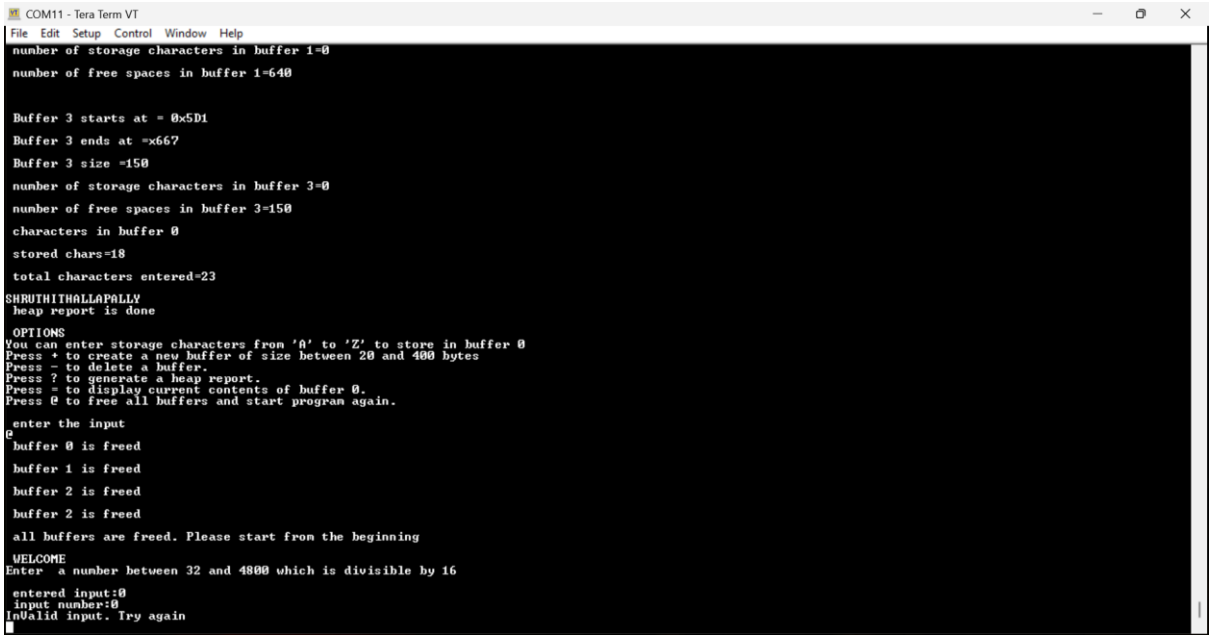
Terminal output depicting the Heap Report when input is “?”



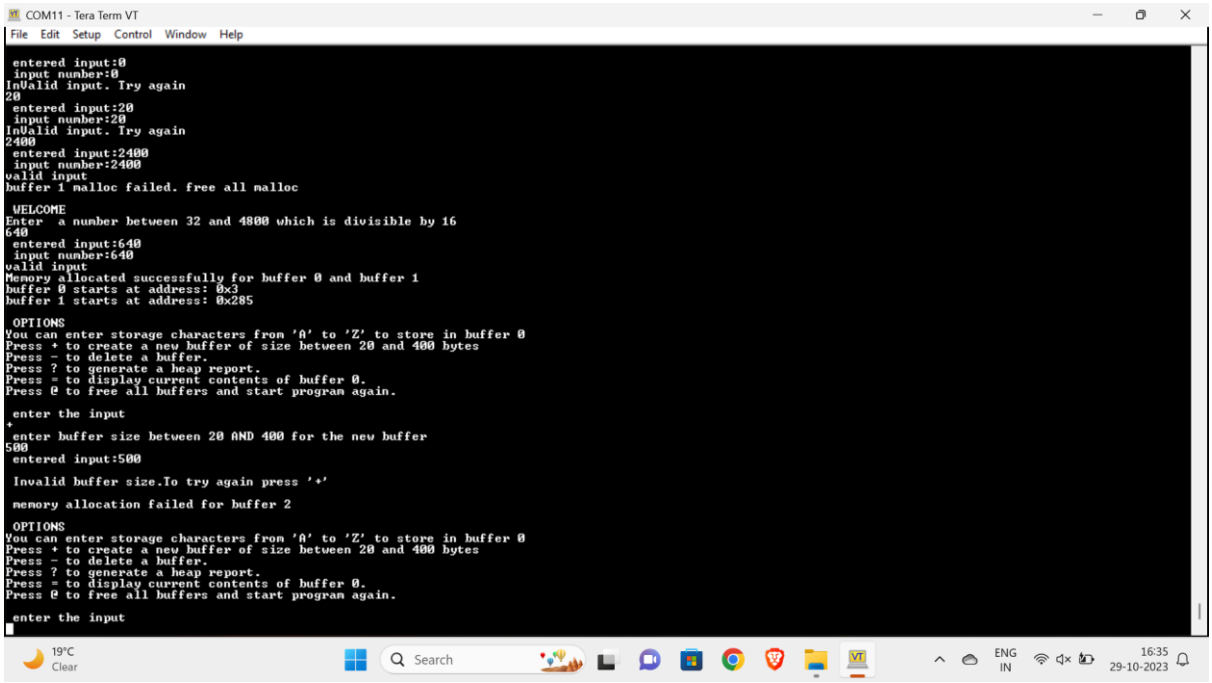
Terminal output depicting the Heap Report when input is “=”



Terminal output 2 depicting the Heap Report when input is “@”

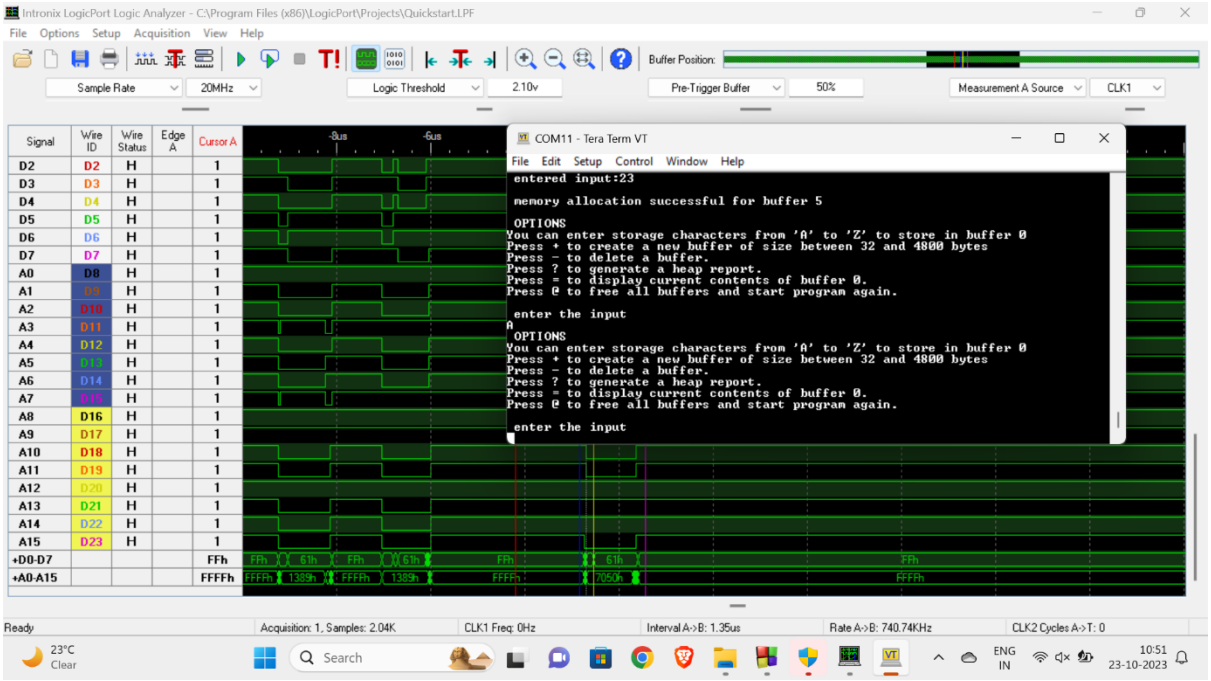


Terminal output 2 when invalid inputs are given.

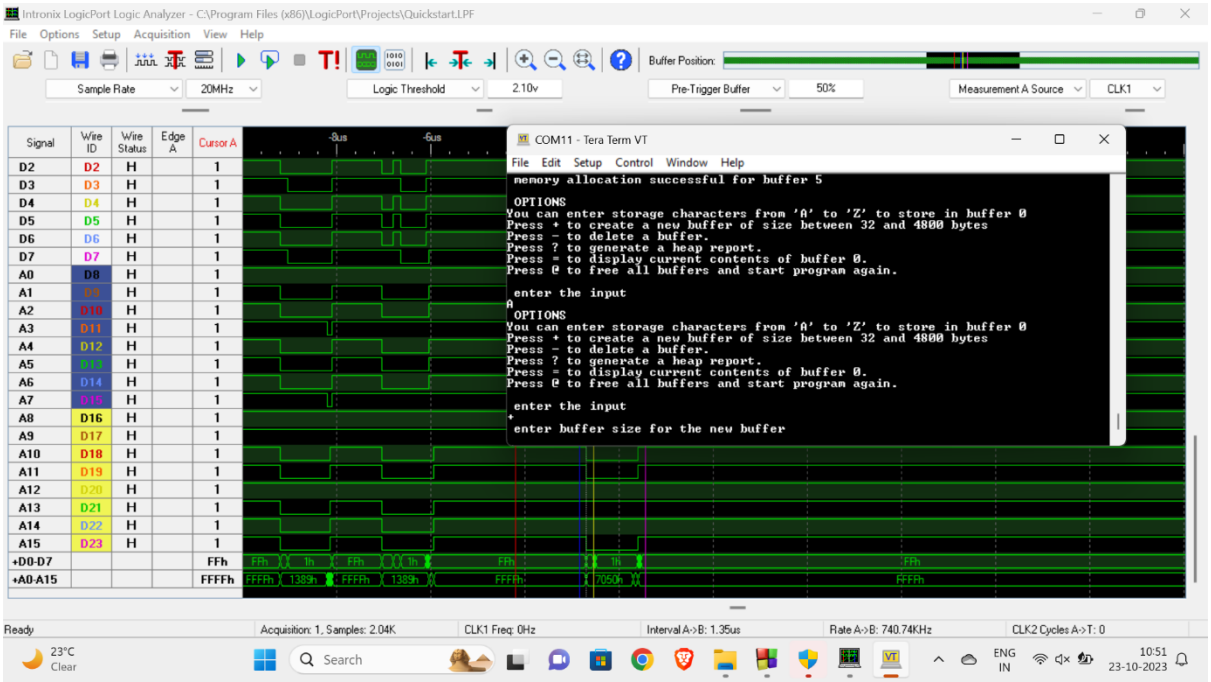


3.Logic analyzer pictures of **Virtual Debug port**.

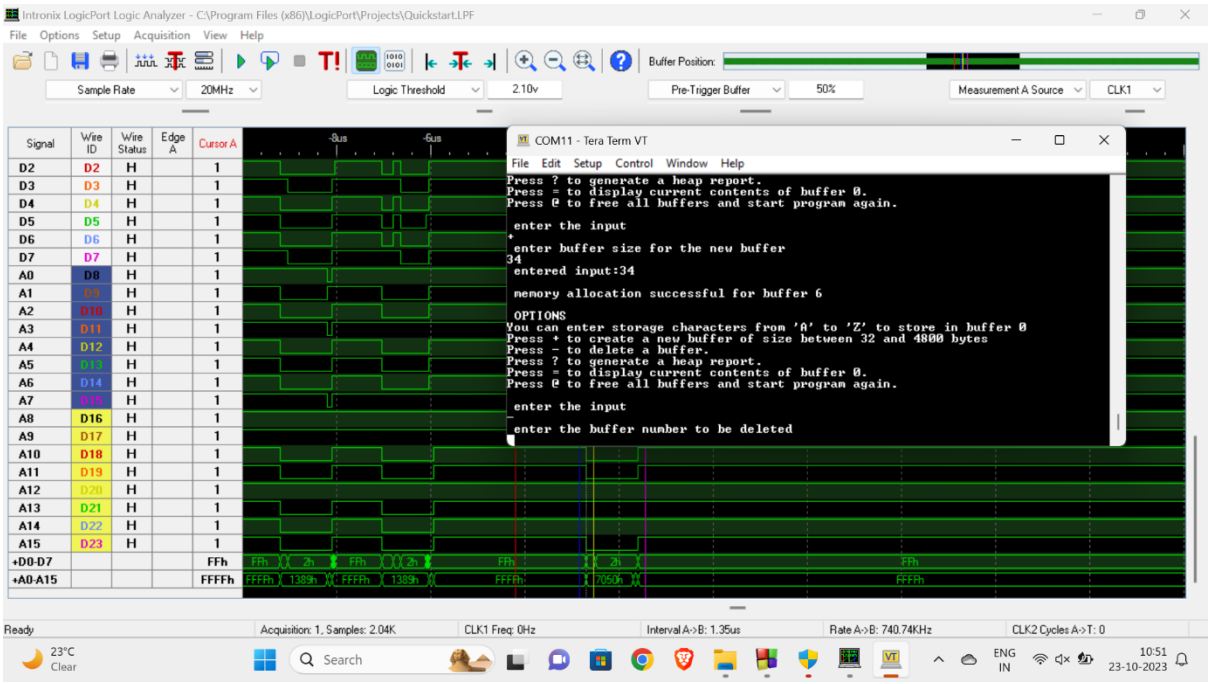
For a storage Character in Buffer 0:



For a “+” input:



For a “-“ input :



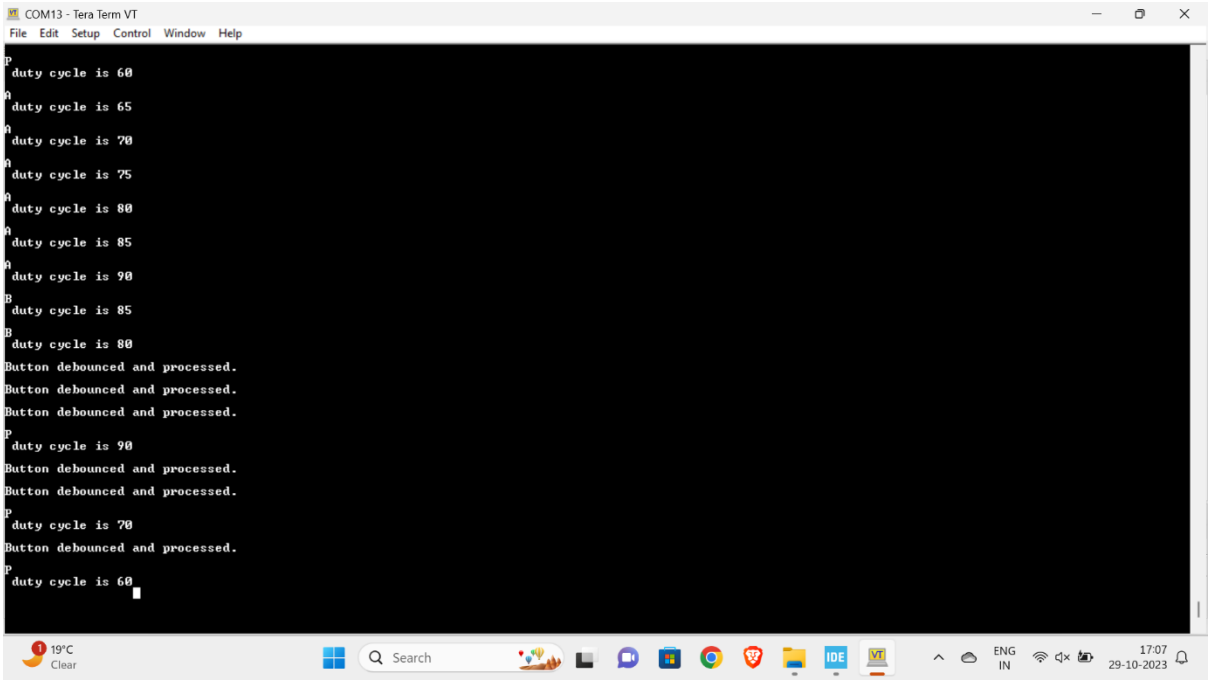
4. **Part3:** Terminal Pictures

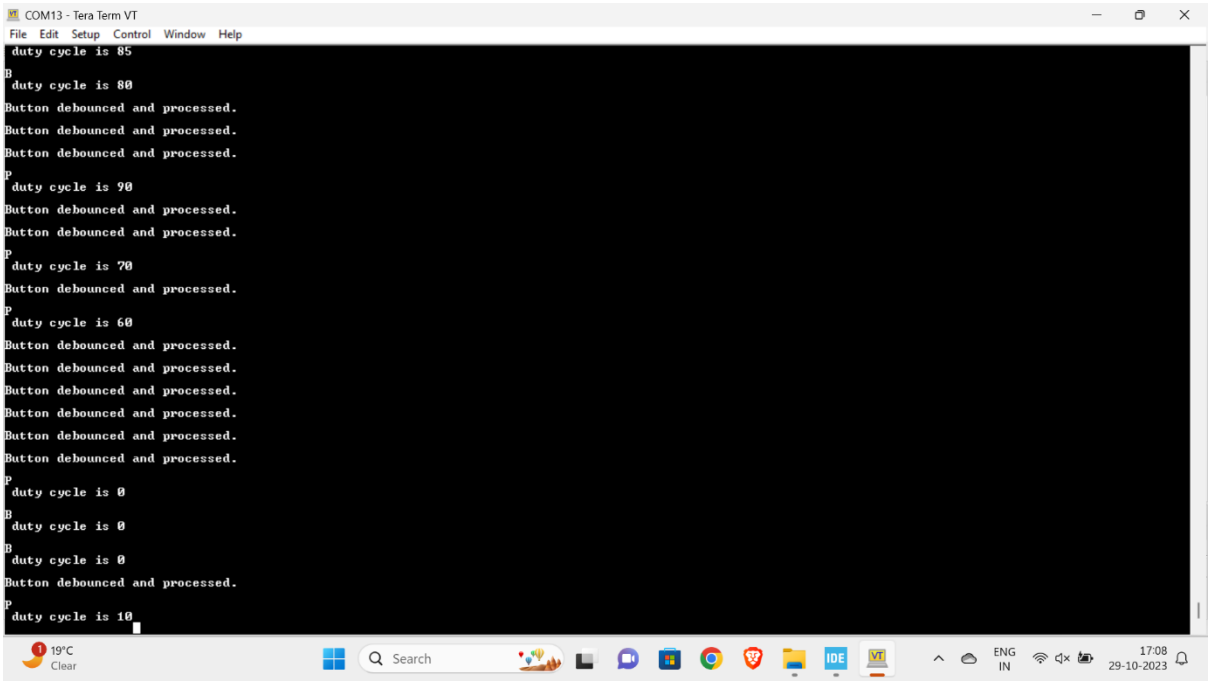
For the required part, one GPIO pin is used to generate the PWM signal with a default 60% duty cycle. The duty cycle increases by 5% every time A is given as input.

The duty cycle decreases by 5% every time A is given as input.

The duty cycle increases/decreases by 10% every time the button is pressed.

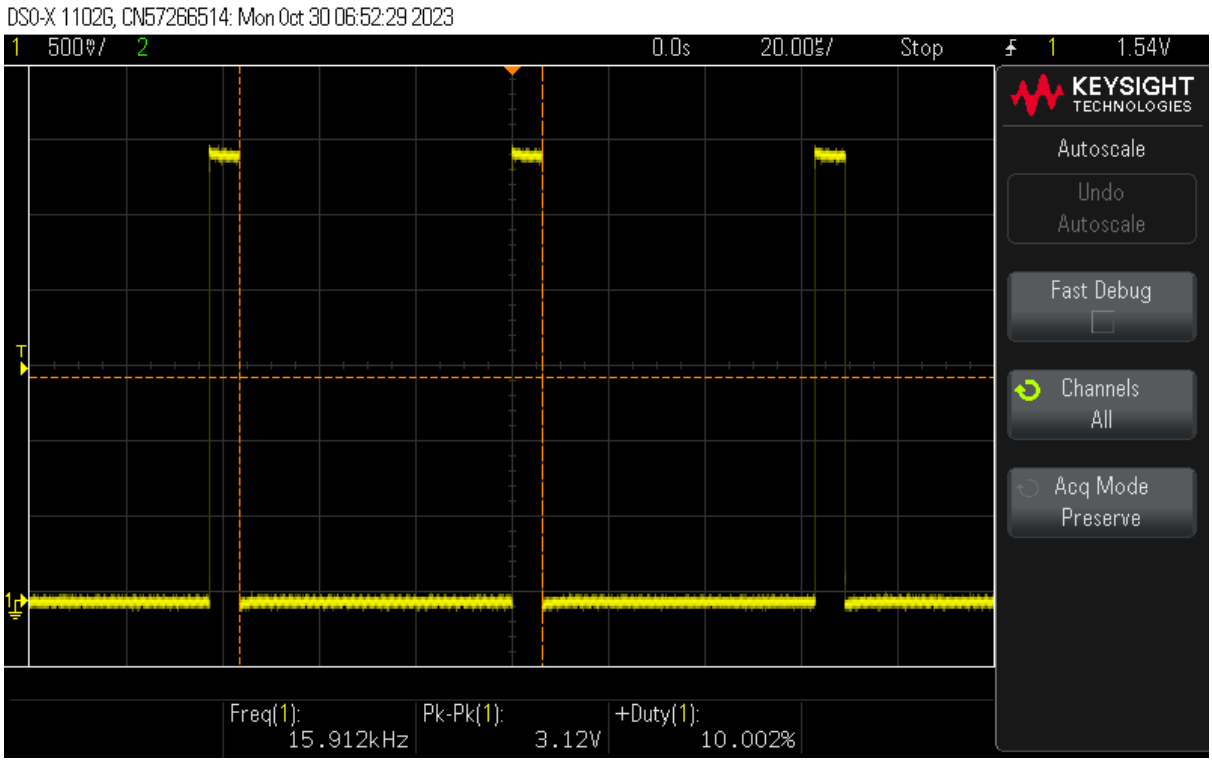
When P is given as input, the current duty cycle is displayed.



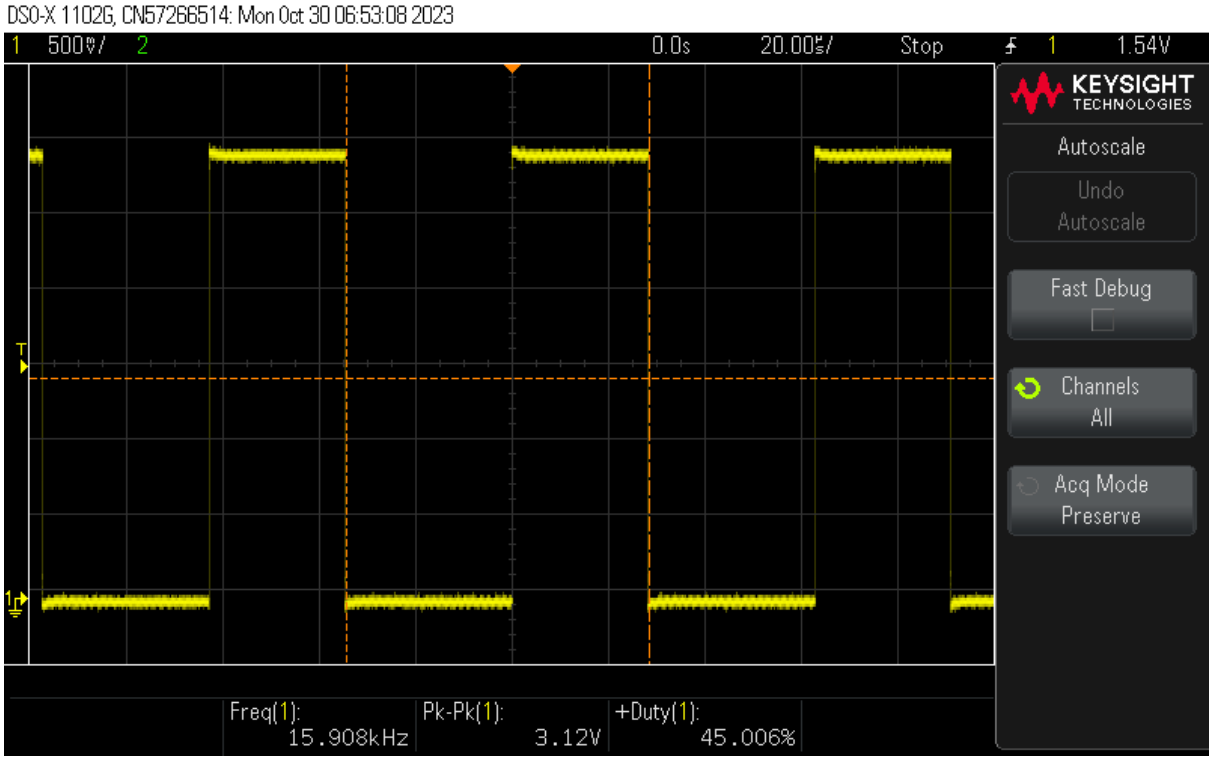


Oscilloscope pictures for different duty cycles varied by giving “A”,”B” and button.

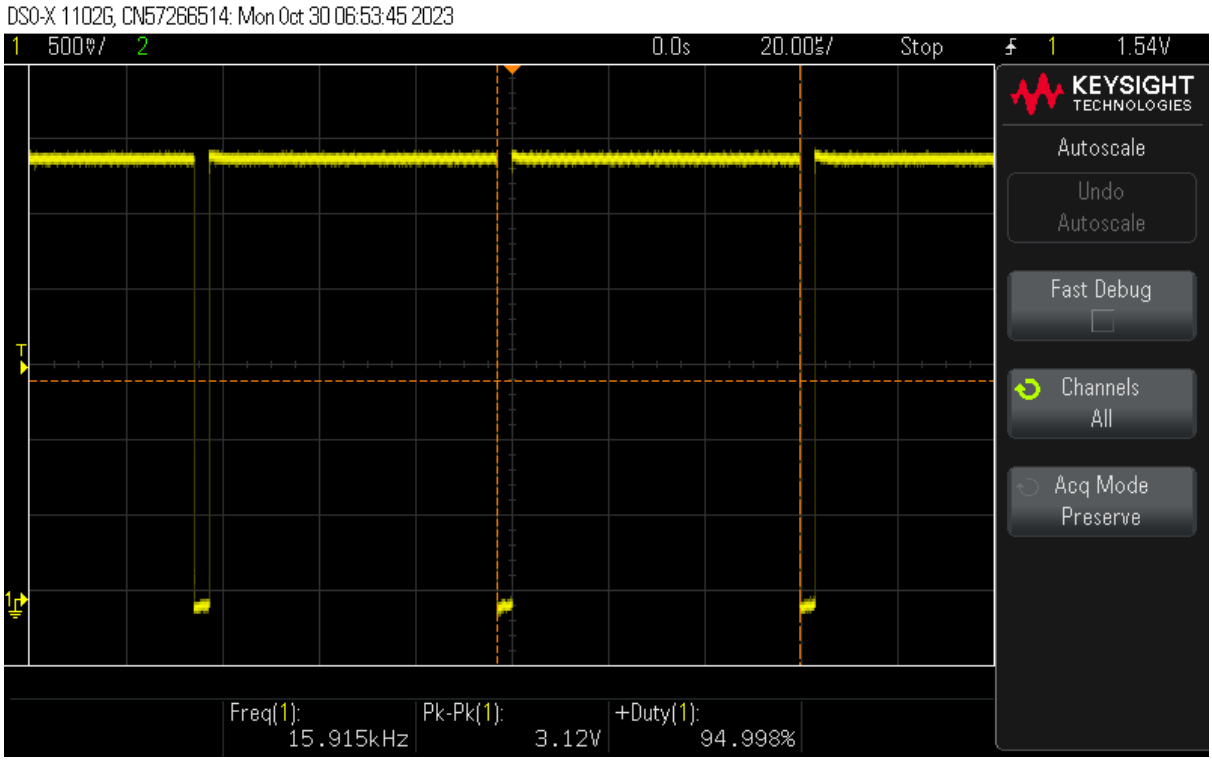
Duty cycle=10%



Duty cycle= 45%



Duty cycle=95%

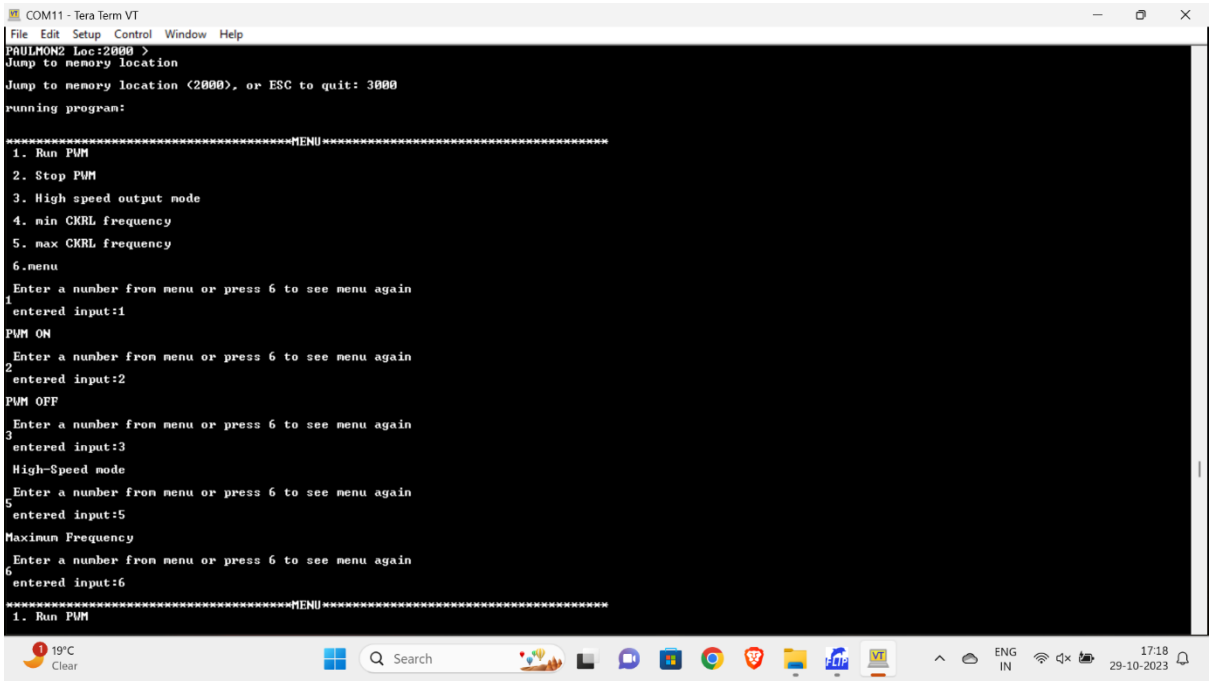


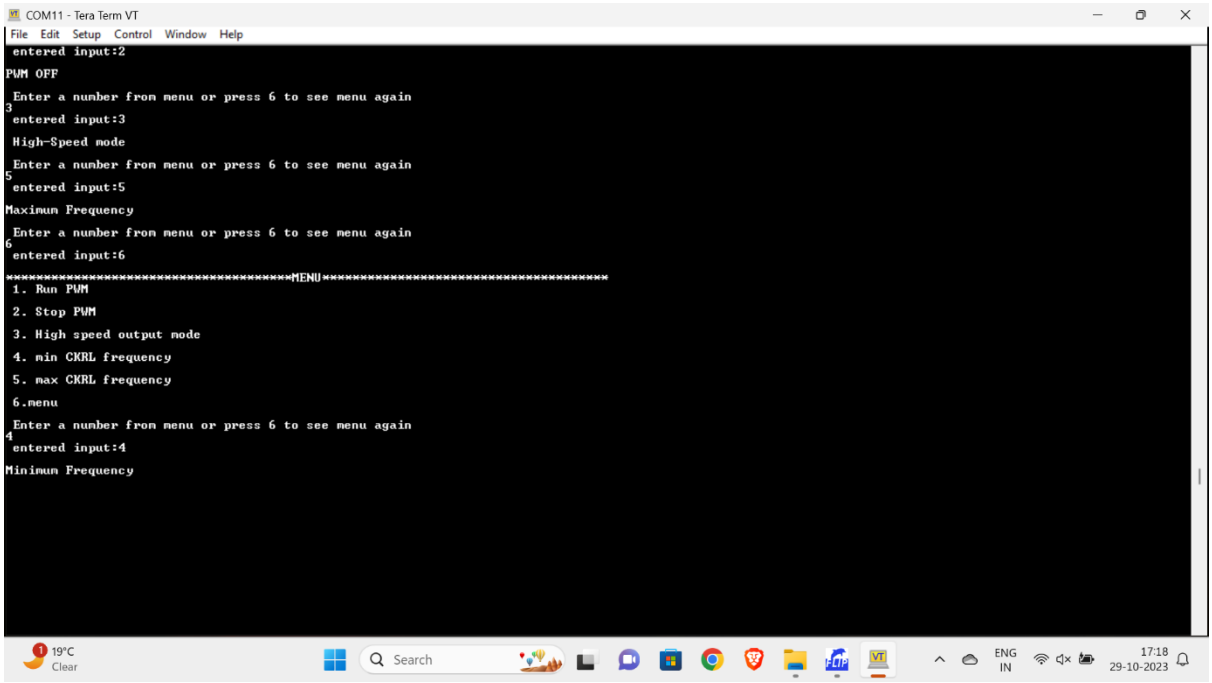
5. Terminal Pictures:

For supplemental elements, demonstrating the PCA modes.

-Pulse Width Modulation

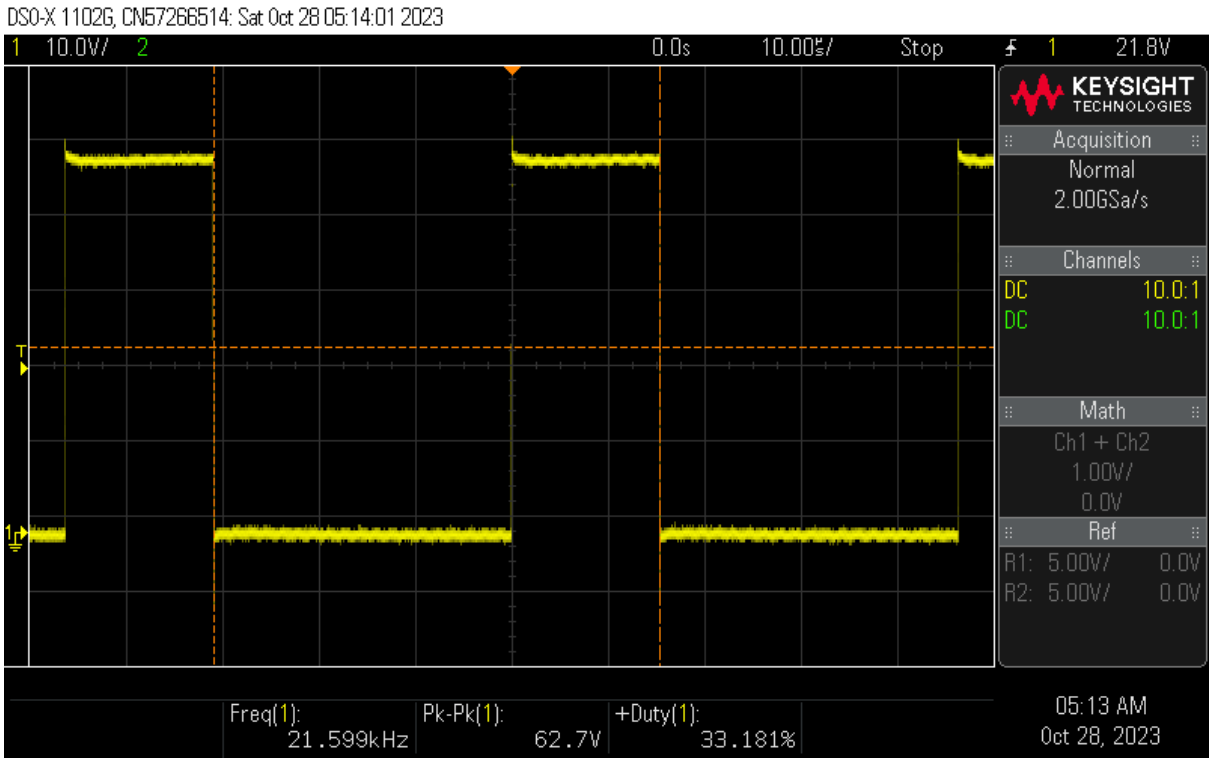
-High-Speed output



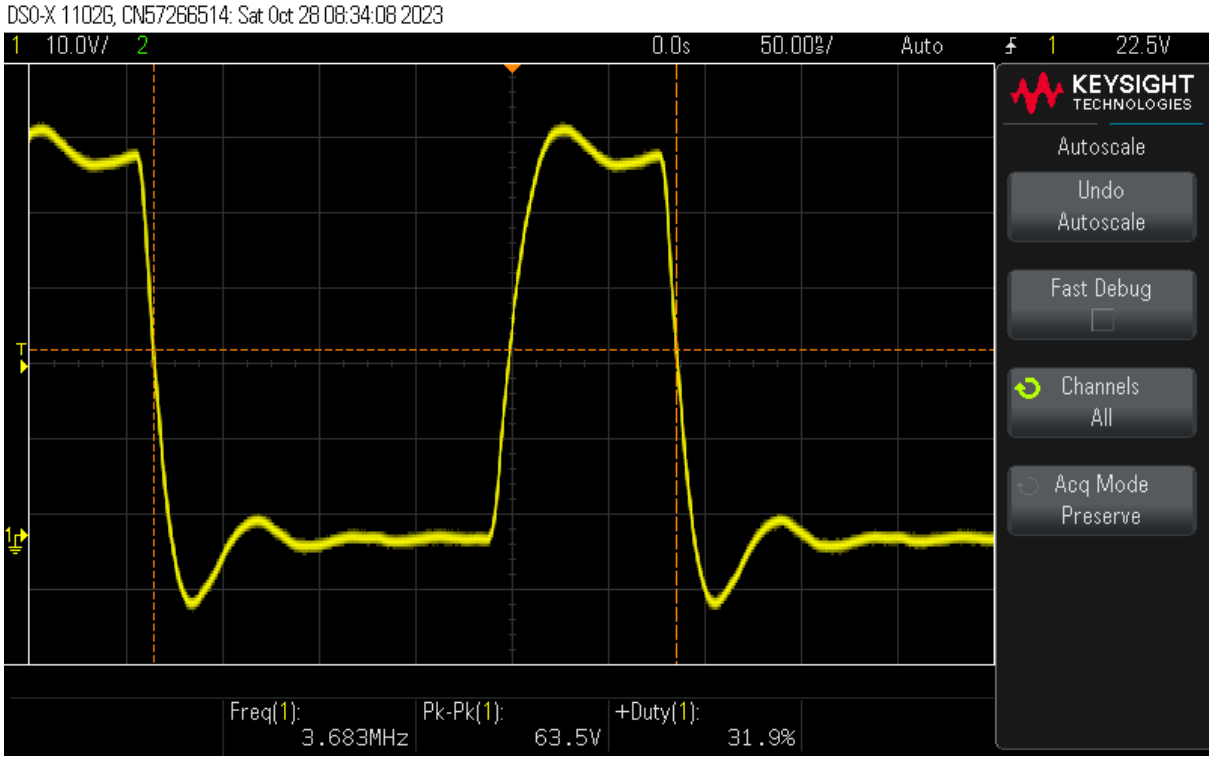


Oscilloscope pictures:

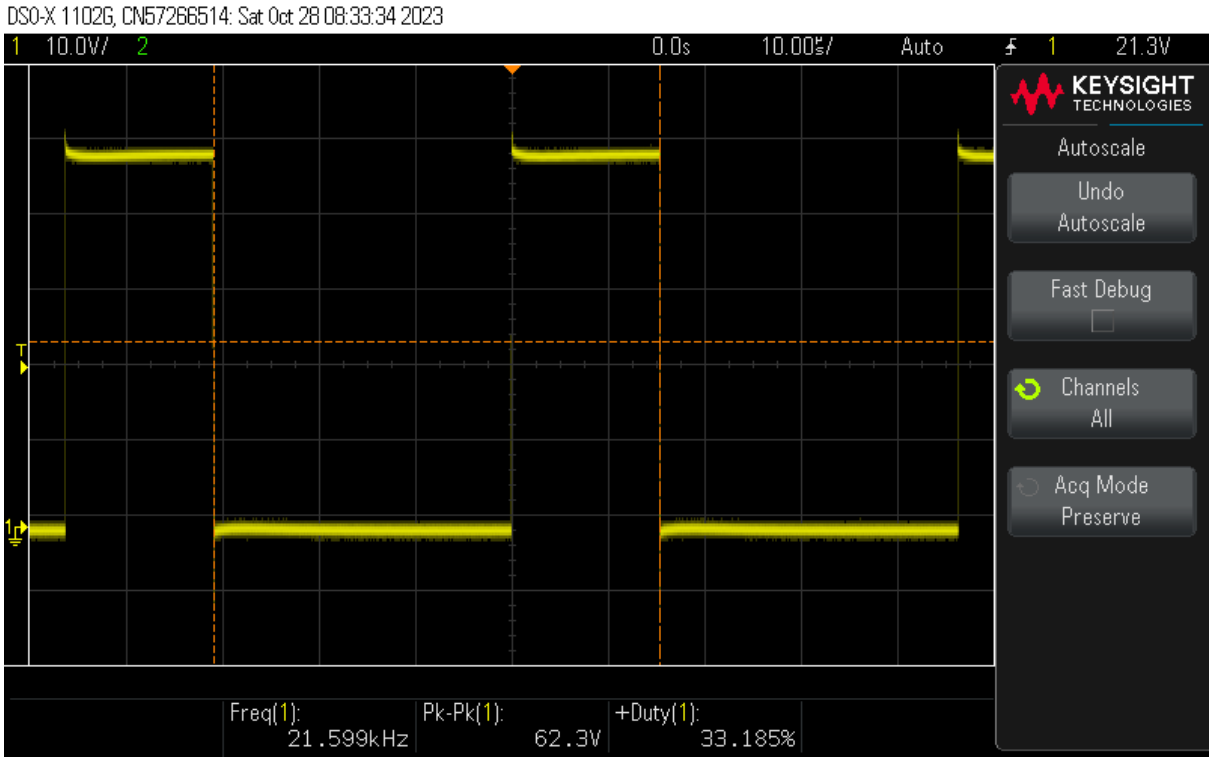
For the supplementary part, one GPIO pin is configured for PWM duty cycle of 33%.



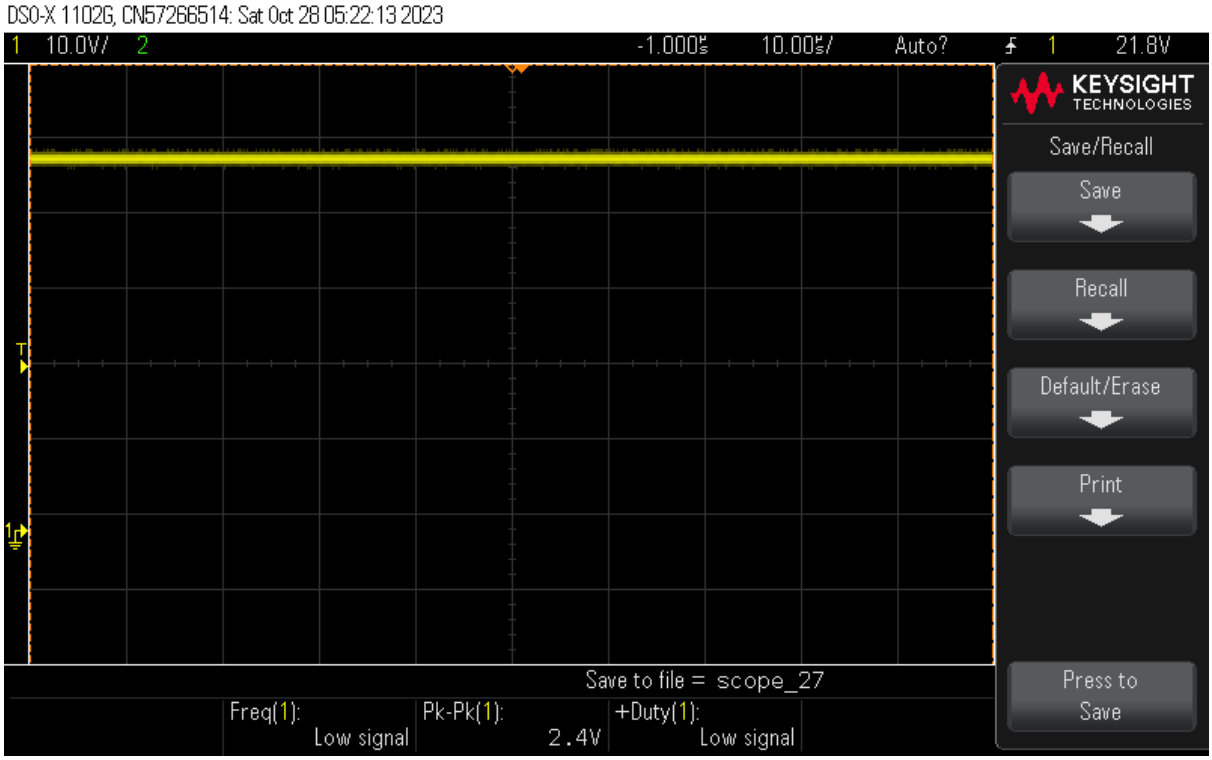
For the supplementary part, one pin is set for High-Speed Output.



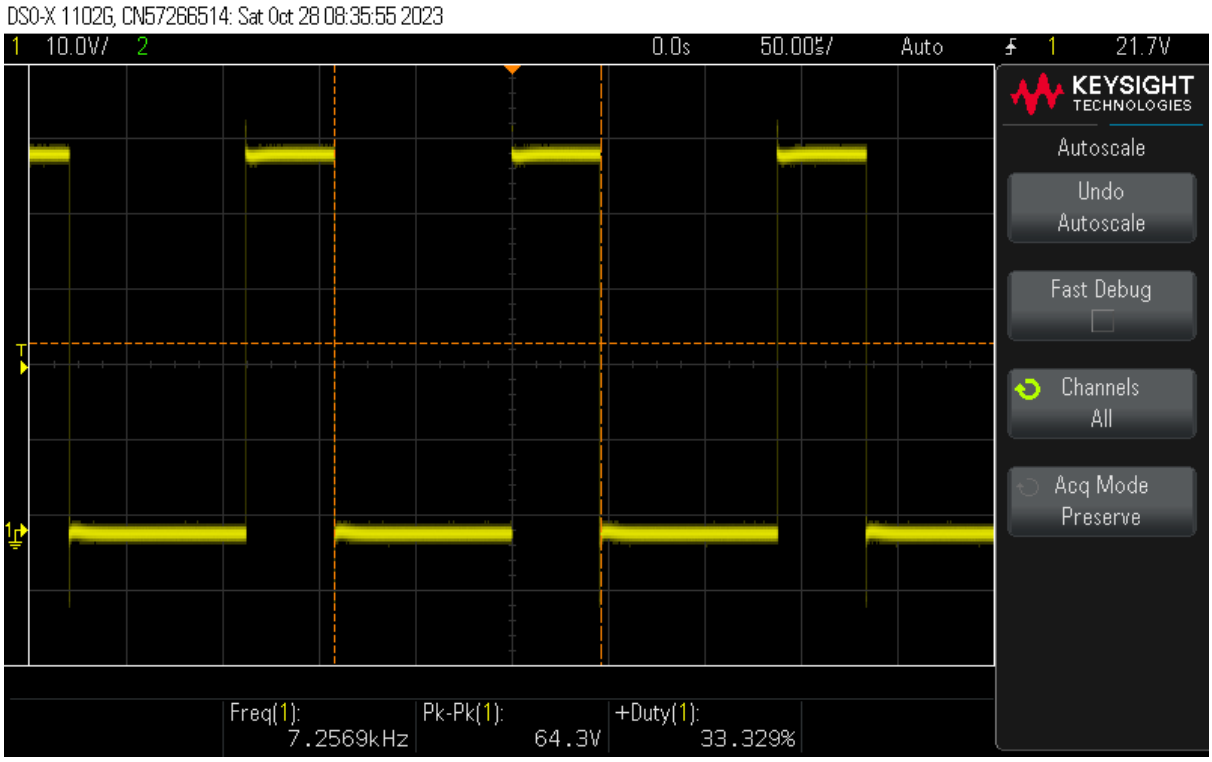
For the supplementary part, when PWM is ON for one pin.



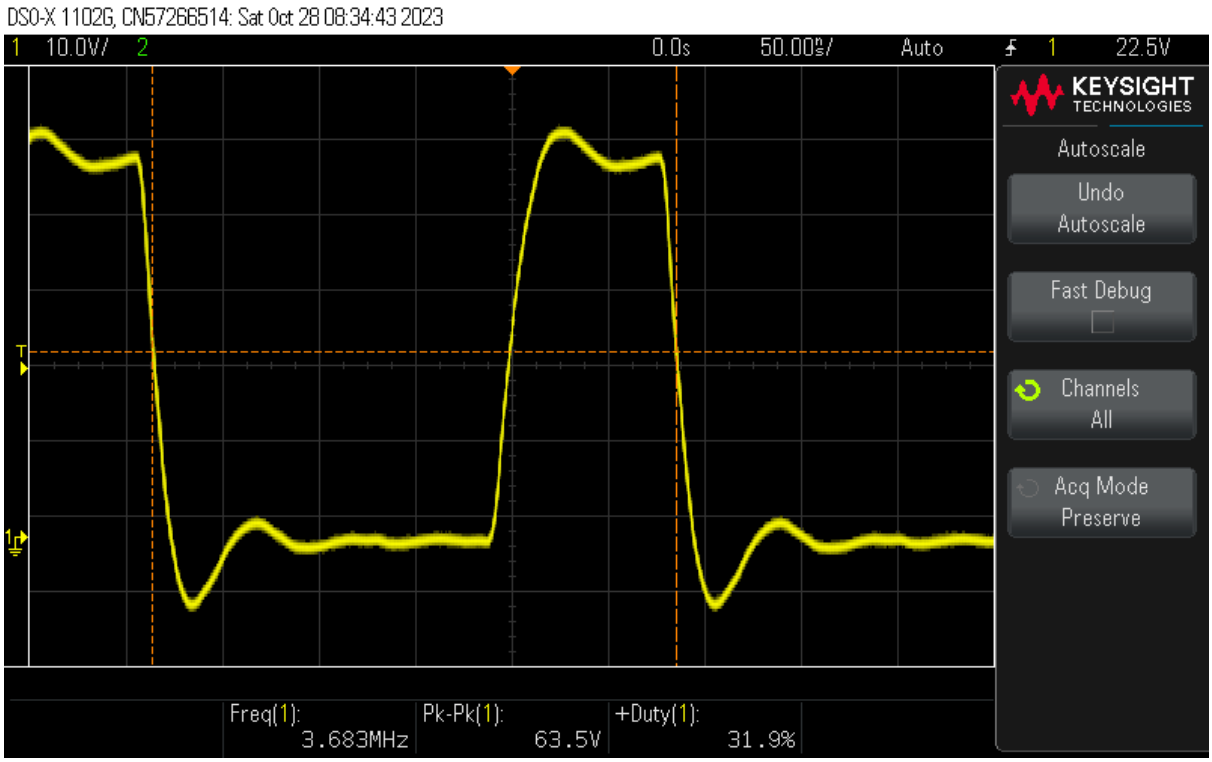
For the supplementary part, when PWM is OFF for one pin.



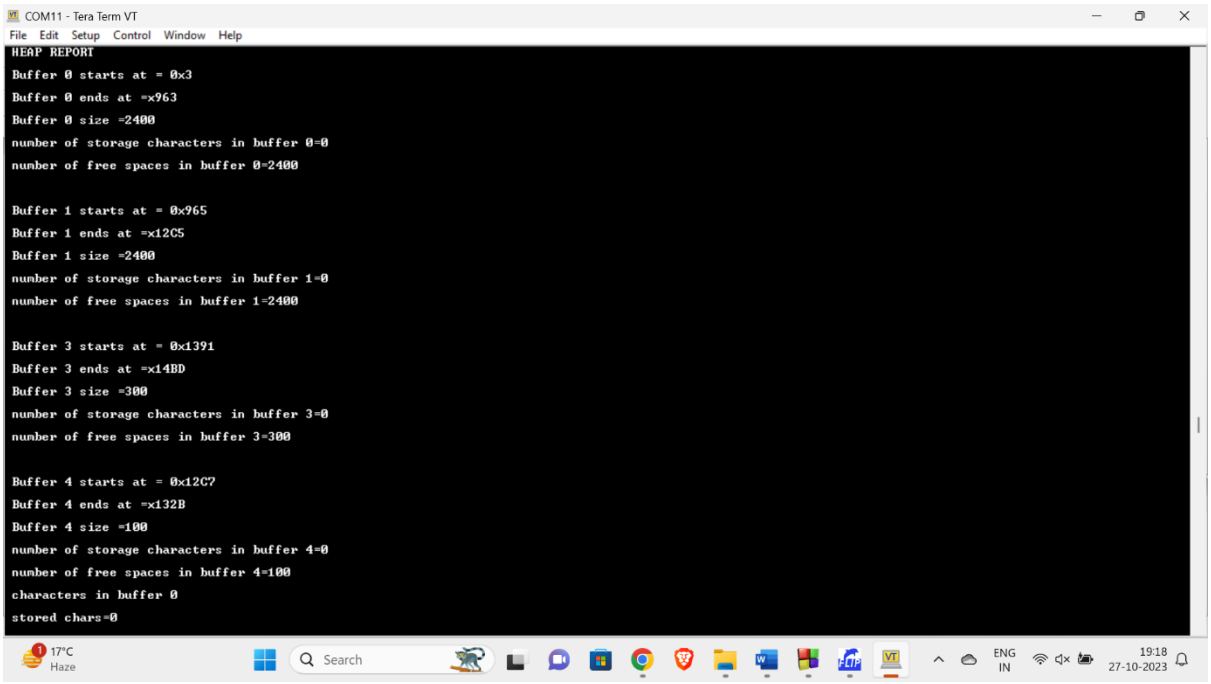
the supplementary part, output at ALE when one pin is set to the minimum peripheral clock frequency supported by the CKRL register.



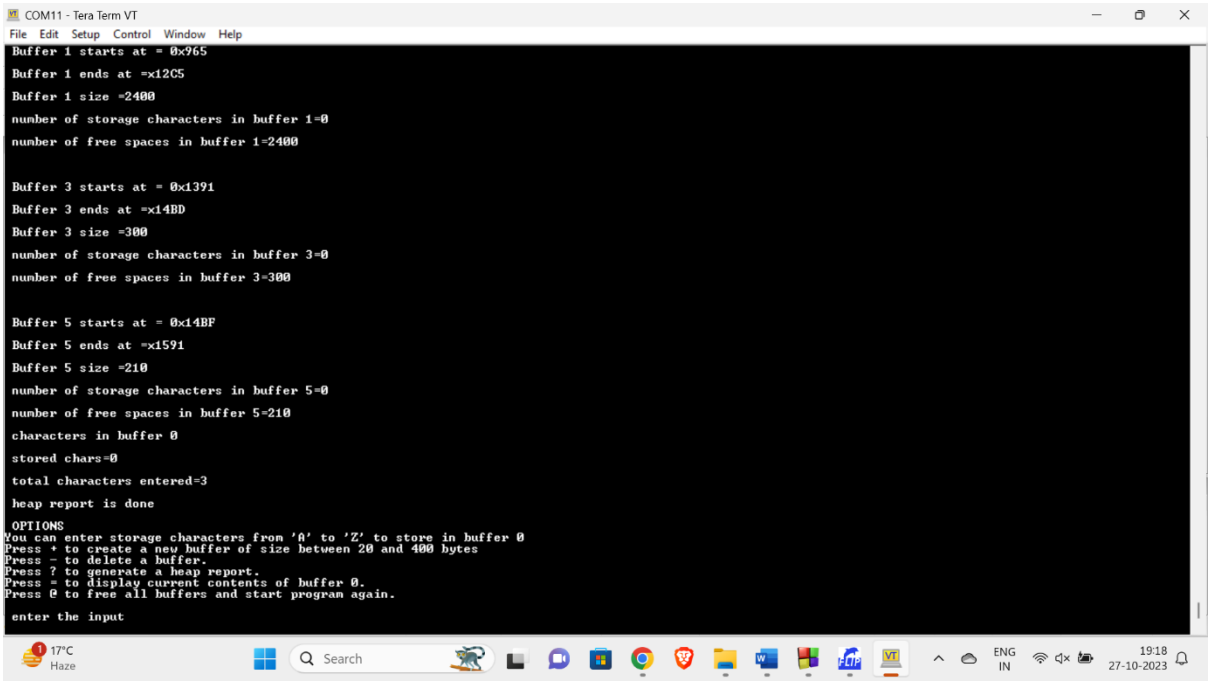
For the supplementary part, output at ALE when one pin is set to the maximum peripheral clock frequency supported by the CKRL register.



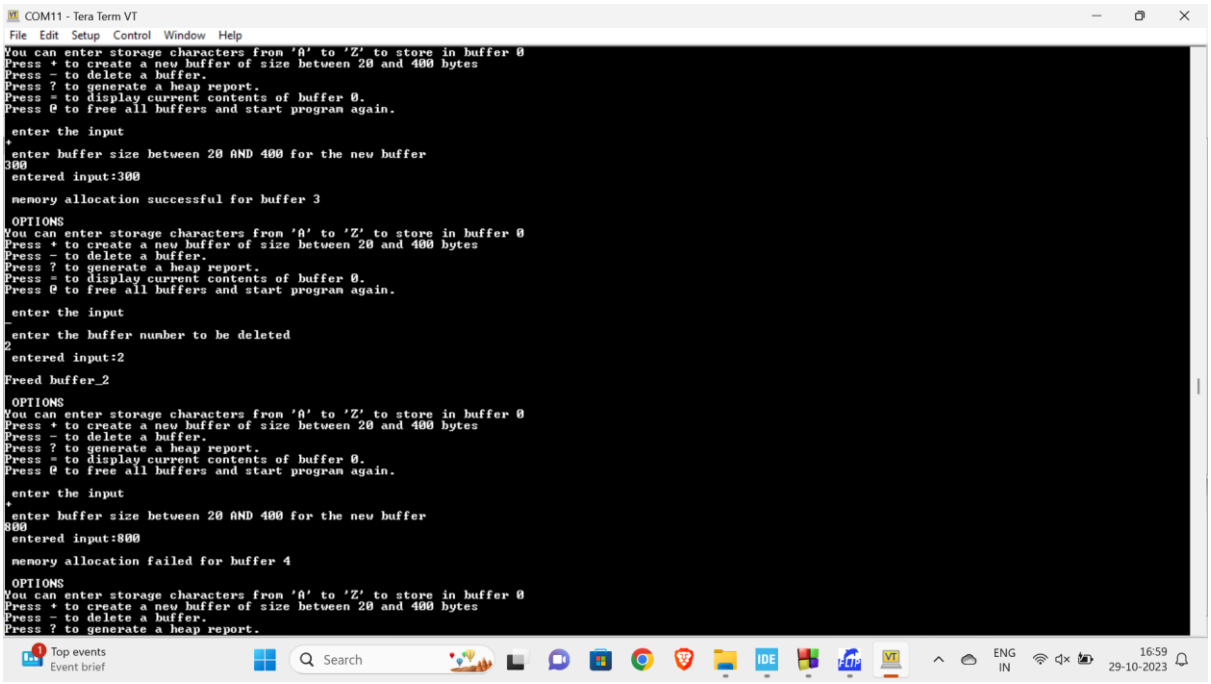
For the optional challenges part, where the heap is created with 5600 bytes. Heap report after creating a buffer of 100 bytes.



For the optional challenges part, where the heap is created with 5600 bytes. Heap report after creating a buffer of 210 bytes.



For the optional challenges part, where the heap is created with 5600 bytes. Heap report after creating a buffer of 800 bytes.



Code snippet which I used to avoid button debouncing.

```
/**
  * @brief Handle the EXTI0 (External Interrupt 0) interrupt
  * @note This function is an interrupt handler.
  */
void EXTI0_IRQHandler(void) {
    if (EXTI->PR & EXTI_PR1_PR0) {
        EXTI->PR |= EXTI_PR1_PR0; // Clear pending bit for EXTI line 0 (PortA Pin 0)

        if (!buttonPressed) {
            TIM2->CR1 |= TIM_CR1_CEN; // Start Timer 2 for debouncing
            buttonPressed = 1; // Set button press state
        }
    }
}

/**
```

SIGNIFICANT LEARNINGS:

- I have learned how to use Paulmon2 commands to modify the data segment and navigate through the program segment.
- I have learned how to run a specific program by jumping to its location using Paulmon2 commands.
- I have learned how to write a User Interface for dynamic memory allocation of buffers in heap memory and perform various functions on it.
- I have learned how to implement PWM using a GPIO pin and change the LED intensity using PWM.
- I have learned about different PCA modes while implementing the supplementary and challenge elements.